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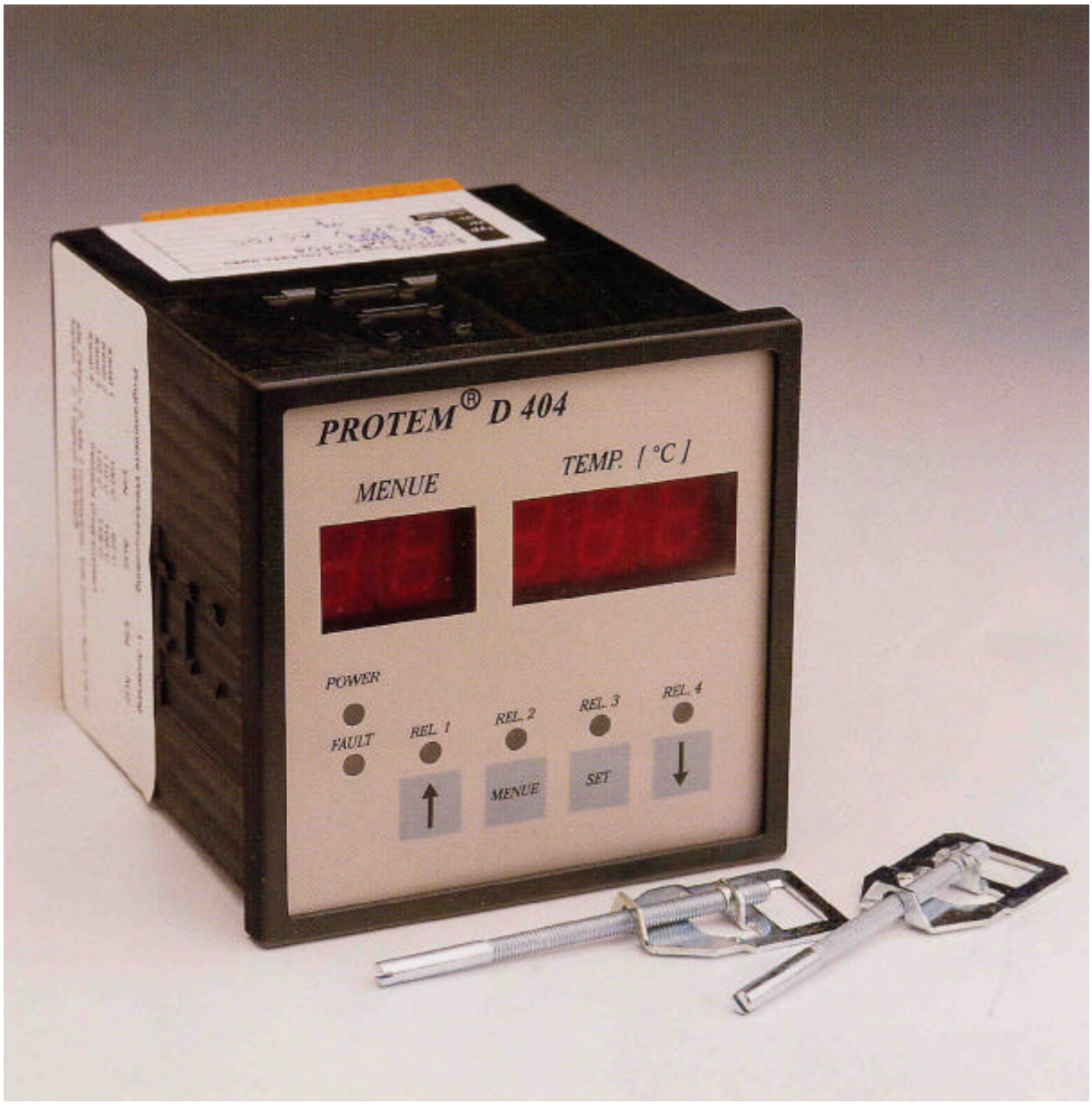


THERMAL PROTECTION EQUIPMENT FOR CAST RESIN TRANSFORMERS

USER MANUAL

UK VERSION 2.2 - 05/01

Table of Contents

Technical Data

1.1 - Power Supply

24... 278V AC/DC ± 15%(DC ... 63 Hz)
The polarity does not need to be taken into consideration.

1.2 - Power Consumption

approx. 3.5 VA

1.3 - Ambient Temperature Range

- 20°C ... + 60°C

1.4 - Measuring Circuits

4 potential-free measuring inputs

1.5 - Measuring Sensors

You have the choice of a PTC, Pt100 (two wire type) or a Pt100 (three wire type) for each measuring circuit. The respective sensor can be selected using the DIP switches at the rear of the device. Any combination of sensors can be selected between the four measuring circuits.

Pt100 measuring range + 15°C to + 220°C (0-250°C)
(The switching points of the respective relay can be freely selected within this range)

PTC Switching Threshold	R on **>** 3500 Q
	R off **<** 2000 Q

1.6 - Relay Output

One relay output is available per measuring circuit. Each relay output is equipped with a potential-free break contact and a potential-free make contact.

The tripping and breaking points can be freely programmed for each relay (only for Pt100 operation). The software can be used to program each relay as a slow-release or time delay relay using a time function.

Relay data:	8 A 220 VAC (cos phi = 1.0)
	5 A 250 VAC (cos phi = 0.4)
	5 A 30 V DC (O ms)
	Hysteresis: 5 x 10^7 (mech.) 10^5 (electr.)

1.7 - Collective Interference Relay

The collective interference relay indicates each of the following device faults via a potential-free make contact, which closes as soon as power is supplied:

1. No power supply
2. Temperature sensor broken
3. Temperature sensor (Pt100) programmable switching point attained

1.8 - Time Functions

Two time functions are available for each relay output (either cut-out or re-close delay). Times between 0 ... 255 seconds or 10 **...** 2550 seconds can be separately selected for each relay input.

Maximum tolerance time range 1 = ± 1 second
Maximum tolerance time range 2 = ± 10 seconds

1.9 - Display

The apparatus is equipped with a 5-digit 7-segment LED display.

1.10 - LED Indicators

4 red LED's indicate the relay status of relays 1 to 4.
1 yellow LED indicates collective fault or power supply failure.
1 green LED indicates the supply voltage is OK.

1.11 - Maximum Value Storage

An EEPROM in the apparatus stores all maximum temperatures in non-volatile memory.

1.12 - Energy Storage System

In case of power supply failure, the apparatus remains in a state of functional readiness for a nominal 10 minutes, during which time the LED display is darkened. The nominal storage time of 10 minutes is only available after 2 hours of power supply operation, because the internal memory capacitor first must be charged up.

1.13 - RS232 Interface

Data can be requested from the apparatus via the built-in RS232 interface with the help of a PC or terminal.
The data is sent on request. See chapter 5 for the protocol description.

Technical data for interface:

Serial interface with TXD, RXD and GND connections.
Transmission speed 9600 baud, 8 bits, no parity and 1 stop bit (fixed settings).

(This function is not available under emergency power!)

1.14-20mA Output

The 4 measured temperatures can be read out using a current loop output (0... 20 mA).

Technical data for output:

Current output 0 ... 20 mA
Tolerance: maximum ± 0.5 mA from final value.

(This function is not available under emergency power 1)

1.15-Test Jack

The test jack can be used to test functions with the help of a tester.
See section 4.5 for description of tester.

1.16- Housing Dimensions

Device for control panel installation, dimensions 96mm x 96mm x 120mm

1.17- Connection Terminals

2.5 mm^2 plug-in
1.5 mm^2 plug-in (sensor connectors)

1.18- Degree of protection

IP 20

2.0 OPERATION

2.1 - Menu items

The display of the apparatus is split into two columns, i.e. the menu column on the left and the data column on the right. The individual data values are listed in the following table:

Manufact. Progr.	Menu Point	Data	Factory settings
	01	Current temperature sensor 1	
	02	Current temperature sensor 2	
	03	Current temperature sensor 3	
	04	Current temperature sensor 4	
	05	Maximum temperature at sensor 1	
	06	Maximum temperature at sensor 2	
	07	Maximum temperature at sensor 3	
	08	Maximum temperature at sensor 4	
	10	Pick up temperature active relay sensor 1	100°C
P	11	Drop out temperature active relay sensor 1	90°C
	12	Pick up temperature collective fault sensor 1*	150°C
T	13	Drop out temperature collective fault sensor 1*	145°C
	14	Drop out delay time active relay sensor 1	000s
100	15	Pick up delay time active relay sensor 1	000s
	16	Drop out delay time collective fault relay sensor 1	000s
(logic)	17	Pick up delay time collective fault relay sensor 1	000s
	20	Pick up temperature active relay sensor 2	110°C
P	21	Drop out temperature active relay sensor 2	100°C
	22	Pick up temperature collective fault sensor 2*	150°C
T	23	Drop out temperature collective fault sensor 2*	145°C
	24	Drop out delay time active relay sensor 2	000s
100	25	Pick up delay time active relay sensor 2	000s
	26	Drop out delay time collective fault relay sensor 2	000s
(logic)	27	Pick up delay time collective fault relay sensor 2	000s
	30	Pick up temperature active relay sensor 3	120°C
P	31	Drop out temperature active relay sensor 3	118°C
	32	Pick up temperature collective fault sensor 3*	150°C
T	33	Drop out temperature collective fault sensor 3*	145°C
	34	Drop out delay time active relay sensor 3	000s
100	35	Pick up delay time active relay sensor 3	000s
	36	Drop out delay time collective fault relay sensor 3	000s
(logic)	37	Pick up delay time collective fault relay sensor 3	000s
	40	Pick up temperature active relay sensor 4	N.A.
P	41	Drop out temperature active relay sensor 4	N.A.
	42	Pick up temperature collective fault sensor 4*	N.A.
T	43	Drop out temperature collective fault sensor 4*	N.A.
	44	Drop out delay time active relay sensor 4	000s
100	45	Pick up delay time active relay sensor 4	000s
	46	Drop out delay time collective fault relay sensor 4	000s
	47	Pick up delay time collective fault relay sensor 4	000s

* Remark:
The programmed switching points of menu items 12, 22, 32 and 42 must be at least 2°C above those of menu items 10, 20, 30 and 40.
The programmed switching points of menu items 13, 23, 33 and 43 must be at least 2°C above those of menu items 12, 22, 32 and 42.

2.2 - Switching Between Menu Items

To switch to a new menu item you must first press the "Menu" button. If the two menu figures blink, this indicates that the selection is active. Now you can change the menu item by using the "up" and "down" keys (the keys are marked with appropriate arrows). If the desired menu point has been reached, the selection must be completed by pressing the "Menu" key again. The menu figures no longer blink. The data, which is displayed, can now be changed if required.

2.3 - Current Temperature

If one of the menu items for the respective current temperature has been activated, a different message appears in the data display depending on the type of sensor.

LED Display

- Pt100 sensor	Temperature in °C	e.g.:125
- PTC	message	P
- no sensor	message	no

Example:

If type PTC was selected for sensor 1, "P" is displayed under menu items 01,05, 10, 11, 12 and 13. Items 14 to 17 still display the respective pick-up or drop-out times. This also applies to all other sensor inputs, but under the respective menu numbers which have been assigned.

2.4 - Maximum Temperature

Menu items 05 to 08 are the respective stored maximum values for the individual sensors. Here the peak value of the measured temperature will be displayed. The value is stored in the EEPROM so that it cannot be lost and can be interrogated at any time. This value can be reset by activating the menu item and then pressing the "Set" button. The display then switches back to the current temperature value for the particular sensor.

2.5 - Data Entry (General)

The system allows data to be entered from menu item 10 onwards. The data can be changed by using the "Up" and "Down" keys when the menu number is not blinking. This can be done by in single steps by pressing the appropriate key once or by fast-forward by holding the key down. A blinking data display indicates that the initial value has been modified and must now be confirmed. If the desired value has been adjusted, entry is completed by pressing the "Set" button. If a change has been made it must be confirmed using "Set", otherwise no other menu item can be selected (confirmation must take place if the display is blinking).

2.6 - Entry of Time Functions

When entering time functions you should consider the following:
when activating a re-close delay time, care must be taken to set the respective cut-out delay time to 000.

This also applies to the reverse situation.

Example:
If a time has been set in menu item 15, the time in menu item 14 must be set to 000 and vice-versa.
This is important, because if both functions are activated (re-close and cut-out delay) the system always recognises the cut-out delay as an active time function.

The two different time ranges (1 ... 255 seconds and 10 ... 2550 seconds) are adjusted by pressing the "Set" key whilst the menu display is blinking and the appropriate valid menu item for time selection is active. In the LED display, the decimal point appears in the units position of the time value.

Each individual sensor can be set to either time range.

Example:
If the long time range has been selected for sensor 1 in menu item 14, this long time is also selected for menu items 15, 16 and 17.

Note:
DIP switch changes S501 and S502 settings are not activated until the power supply has been switched off and the capacitors have discharged. (Green and yellow LEDs must be off)!

3.0 DIP SWITCHES

3.1 - Switch S501

The sensor type can be selected using DIP switch S501 (located at the top).See following table:

I		II		III		IV		Channel	Channel
1	2	3	4	5	6	7	8	Switch No.	
ON	ON	X	X	X	X	X	X	Sensor 1 = no sensor	I
OFF	ON	X	X	X	X	X	X	Sensor 1 = PTC	
ON	OFF	X	X	X	X	X	X	Sensor 1 = Pt100	
OFF	OFF	X	X	X	X	X	X	Sensor 1 = Pt100 logic	
X	X	ON	ON	X	X	X	X	Sensor 2 = no sensor	II
X	X	OFF	ON	X	X	X	X	Sensor 2 = PTC	
X	X	ON	OFF	X	X	X	X	Sensor 2 = Pt100	
X	X	OFF	OFF	X	X	X	X	Sensor 2 =Pt100 logic	
X	X	X	X	ON	ON	X	X	Sensor 3 = no sensor	III
X	X	X	X	OFF	ON	X	X	Sensor 3 = PTC	
X	X	X	X	ON	OFF	X	X	Sensor 3 = Pt100	
X	X	X	X	OFF	OFF	X	X	Sensor 3 =Pt100 logic	
X	X	X	X	X	X	ON	ON	Sensor 4 = no sensor	IV
X	X	X	X	X	X	OFF	ON	Sensor 4 = PTC	
X	X	X	X	X	X	ON	OFF	Sensor 4 = Pt100	
X	X	X	X	X	X	OFF	OFF	Sensor 4 =Pt100 logic	

ON = switch in ON position
OFF = switch in OFF position
x = switch position irrelevant

Note concerning Pt1OO logic

All sensor inputs that are detected with switch setting Pt100 logic have the following function. The respective relays for the individual channels have a logical connection to the activated sensor. For example, this means that when two channels have the logic setting, the set threshold values apply for both inputs.

The respective relay is switched on when temperature Pt100(1) OR Pt100(2) is greater than the set temperature. The relay switches off when temperatures Pt100(1) AND Pt100(2) are below the set temperature.

This linking can take place for any combination of the four sensors.

Example:

-Sensor 1 (Pt100 Logic set)
Switch-on threshold 30°C, switch-off threshold 20°C

-Sensor 2 (Pt100 Logic set)
Switch-on threshold 40°C, switch-off threshold 30°C

-Sensor 3 (Pt100 Logic set)
Switch-on threshold 50°C. switch-off threshold 40°C

Procedure 1: The temperature at sensor 1 slowly rises from 10°C to 60°C

-Temperature ≥ 30° relay 1 switches ON
-Temperature ≥ 40° relay 2 switches ON (relay 1 stays on)
-Temperature ≥ 50° relay 3 switches ON (the two others stay on)

The same applies to the other two channels.

The reverse order applies when switching off. However, here the temperatu on all three channels must be below the switch-off threshold for the respect relay to switch off.

For example: relay 3 = OFF = sensor 1 AND sensor 2 AND sensor 3 ≤ 40°C

The function of the collective fault relay-switching threshold is configured as for Pt100 normal operation.

Example:

The sensor combination has remained the same, but the temperature thresholds for the collective fault relay are:

ON ≥ 180°C, OFF ≤ 170°C for sensor 1
ON ≥ 200°C, OFF at ≤ 190°C for sensors 2 and 3

Procedure:

Temperature at sensor 1 rises from 150°C to 180°C; temperature at sensors and 3 lies at 45°C;

-Temperature sensor 1 = 150°C	Relays 1, 2 and 3 are ON
-Temperature sensor 1 ≥ 180°C	Relays 2 and 3 are ON; Relay 1 switches OFF Common interface relay switches ON

3.2 - Switch S502

The respective input circuits (protective resistors) can be selected for each measuring input with the help of DIP switch S502 (bottom switch). See following table:

I		II		III		IV		Channel	Channel
1	2	3	4	5	6	7	8	Switch No.	
ON	X	X	X	X	X	X	X	Protective resistor PTC Pt100 sensor 1 on	I
OFF	X	X	X	X	X	X	X	Protective resistor PTC Pt100 sensor 1 off	
X	ON	X	X	X	X	X	X	Parallel resistor PTC Pt100 sensor 1 on	
X	OFF	X	X	X	X	X	X	Parallel resistor PTC Pt100 sensor 1 off	
X	X	ON	X	X	X	X	X	Protective resistor PTC Pt100 sensor 2 on	II
X	X	OFF	X	X	X	X	X	Protective resistor PTC Pt100 sensor 2 off	
X	X	X	ON	X	X	X	X	Parallel resistor PTC Pt100 sensor 2 on	
X	X	X	OFF	X	X	X	X	Parallel resistor PTC Pt100 sensor 2 off	
X	X	X	X	ON	X	X	X	Protective resistor PTC Pt100 sensor 3 on	III
X	X	X	X	OFF	X	X	X	Protective resistor PTC Pt100 sensor 3 off	
X	X	X	X	X	ON	X	X	Parallel resistor PTC Pt100 sensor 3 on	
X	X	X	X	X	OFF	X	X	Parallel resistor PTC Pt100 sensor 3 off	
X	X	X	X	X	X	ON	X	Protective resistor PTC Pt100 sensor 4 on	IV
X	X	X	X	X	X	OFF	X	Protective resistor PTC Pt100 sensor 4 off	
X	X	X	X	X	X	X	OFF	Parallel resistor PTC Pt100 sensor 4 on	
X	X	X	X	X	X	X	ON	Parallel resistor PTC Pt100 sensor 4 off	

ON = switch in ON position
OFF = switch in OFF position
x = switch position irrelevant

Using switch S502, the user selects the appropriate input circuit for the respective sensor. This is for switching a protective resistor into PTC or Pt100 operation. If several sensor inputs are switched in parallel at one PTC or Pt100, this resistor must be switched off at the inputs which have been switched in parallel. This also applies for the PTC parallel resistor. This resistor is only needed in PTC operation for linearising the characteristic curve of a single sensor.

The resistor must be cleared for all other operating modes.

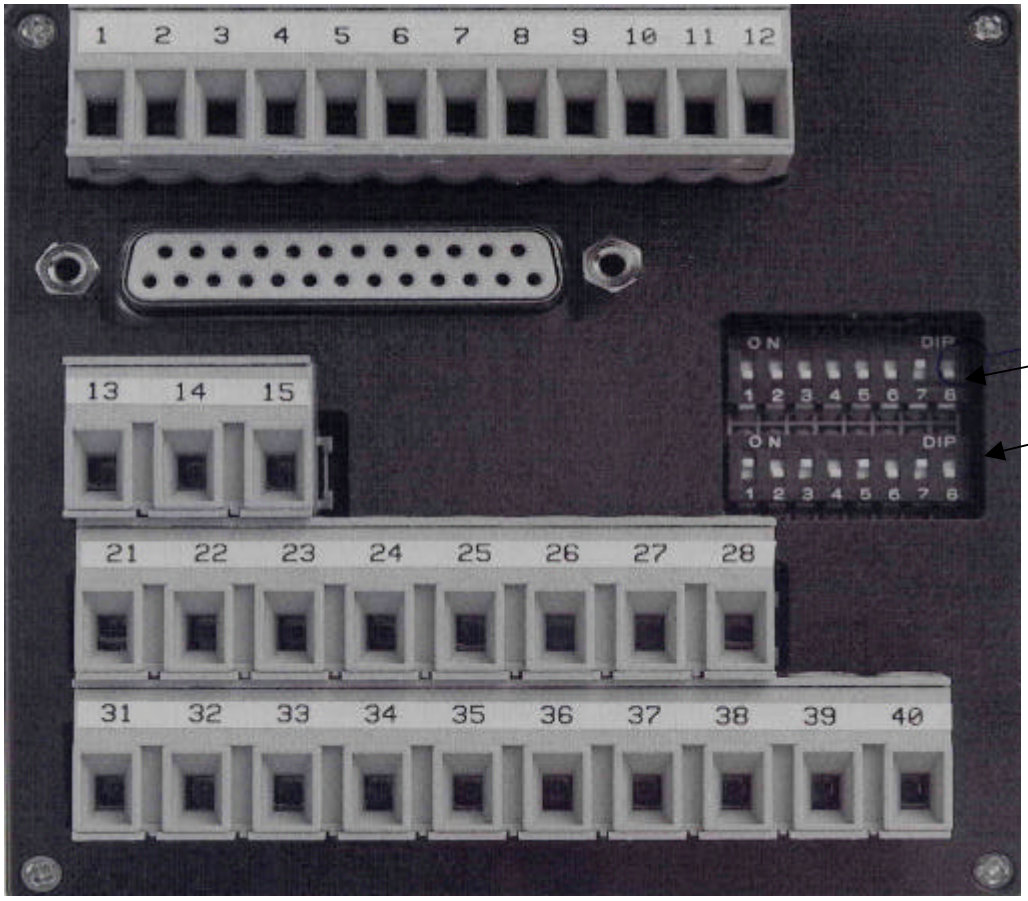
Example:
Sensor 1 should have a Pt100) three-line connection, a PTC at sensors 2 and 3 and no element at sensor 4 but a second relay function for sensor 1. In this case, the switch settings should be as follows:

-Sensor 1 Pt100
Switch 1 ON (PTC protective resistor on, because Pt100 connected)
Switch 2 OFF (PTC parallel resistor off, because no PTC used here)

-Sensor 2 PTC
Switch 3 ON (PTC protective resistor on, because PTC connected)
Switch 4 ON (PTC parallel resistor on, because PTC used here)

-Sensor 3 PTC
Switch 5 ON (PTC protective resistor on, because PTC connected)
Switch 6 ON (PTC parallel resistor on, because PTC used here)

-Sensor 4 parallel to sensor 1 (conn. 2 of sensors 1 and 4 bridged)
Switch 7 OFF (PTC protective resistor on, because parallel operation is taking place)
Switch 8 OFF (PTC parallel resistor off, because no PTC used here)



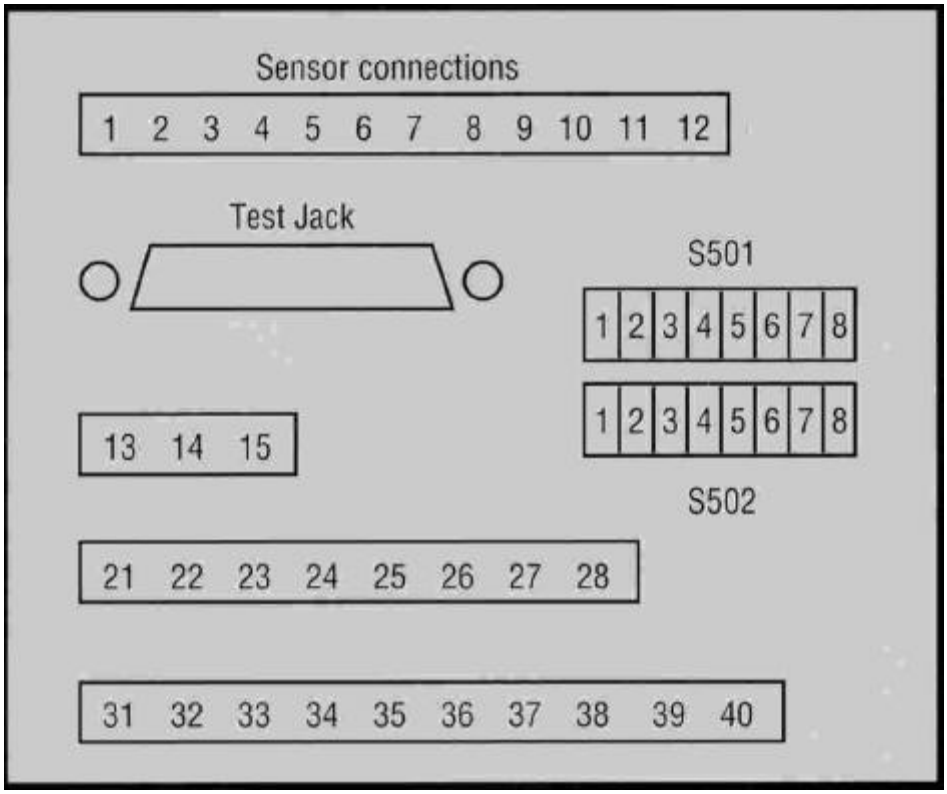
4.1 - Relay Contact Configuration

Relay 1 break contact NC	Terminals 31 and 32
Relay 1 make contact NO	Terminals 33 and 34
Relay 2 break contact NC	Terminals 35 and 36
Relay 2 make contact NO	Terminals 37 and 38
Relay 3 break contact NC	Terminals 21 and 22
Relay 3 make contact NO	Terminals 23 and 24
Relay 4 break contact NC	Terminals 25 and 26
Relay 4 make contact NO	Terminals 27 and 28
Collective interference make contact	Terminals 39 and 40

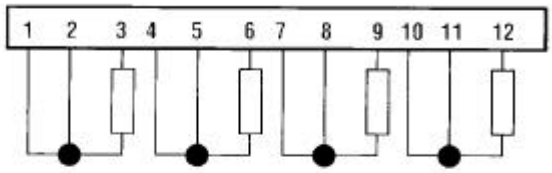
4.2 - Power Supply Connector

The power supply is connected at terminals 13 and 15.
(polarity does not have to be taken into consideration)

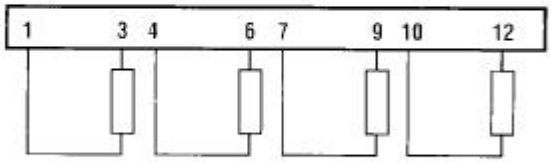
4.3 - Viewed From Rear



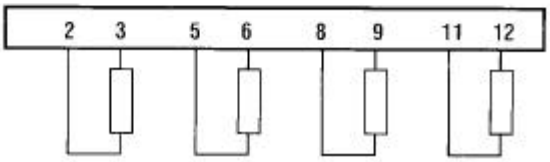
4.4 – Sensor connector



Pt100 Three wire sensor



Pt100 Two wire sensor



PTC sensor

4.5 - Test Jack

The following table shows the configuration of the 25-pin D-sub socket.

Test Jack configuration:

Pin 1	not used
Pin 2	TXD connection for RS232 interface
Pin 3	RXD connection for RS232 interface
Pin 4	not used
Pin 5	not used
Pin 6	not used
Pin 7	GND for RS232 interface
Pin 8	Connection 2, sensor 1
Pin 9	Connection 1, sensor 2
Pin 10	Connection 3, sensor 2
Pin 11	Connection 2, sensor 3
Pin 12	Connection 1, sensor 4
Pin 13	Connection 3, sensor 4
Pin 14	not used
Pin 15	- pole current loop output
Pin 16	+ pole current loop output
Pin 17	not used
Pin 18	not used
Pin 19	not used
Pin 20	Connection 1, sensor 1
Pin 21	Connection 3, sensor 1
Pin 22	Connection 2, sensor 2
Pin 23	Connection 1, sensor 3
Pin 24	Connection 3, sensor 3
Pin 25	Connection 2, sensor 4

Note:

The current output is not in any way connected to earth and may only be loaded with a shunt resistor or measuring device
(I max. = 20 mA at U max. = 2V)

5.0 RS232 OPERATION

5.1 Protocol

The apparatus is designed for communications via an RS232 interface. The connection is made using a cable. Data can be obtained from the system by using a simple protocol. The data transmission speed should be taken from the technical information in chapter 1.

The protocol for obtaining the data comprises 5 commands, which must be sent to the apparatus sequentially.

1st command ^B	Start of Text	(Press STRG + B)
2ndcommand ^B	Start of Text	(Press STRG + B)
3rd command Command		
4th command D	Device identifier	
5th command CR or ^M	End of Text	(Press Return key)

Command	Function
A	Current temperature, sensor 1
B	Current temperature, sensor 2
C	Current temperature, sensor 3
D	Current temperature, sensor 4
E	Maximum temperature, sensor 1
F	Maximum temperature, sensor 2
G	Maximum temperature, sensor 3
H	Maximum temperature, sensor 4
I	S501 switch setting
J	Relay status, relays 1 to 4

After the command has been sent to the device, the required information appears immediately on the screen in text format.

Example:

The current temperature was requested using command sequence ^B^BAD^M**.** Subsequently the reply D025 will appear on the screen if the temperature is 25°C. The D identifier will always be sent at the start of the reply in order to differentiate between different types of device.

Note!

The data can be requested from any PC-compatible computer or standard terminal. If a PC is used, suitable terminal emulation software must be loaded, e.g. Microsoft Windows 3.0 or 3.1 terminal emulator. This software is optionally available on a 3,5" diskette (for MS-DOS version 5.0 and higher, for Windows version 3.0 and higher).